The origin of stylolites in the Ilam Formation (Lorestan Province) SE Iran

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I. Summary

The stylolites of the Ilam Formation in the Lorestan Province have been investigated. The aim of the study is to distinguish diagenetic stylolites from tectonic ones in this formation. Field observation clearly shows two kinks of stylolite. The interpretarion of the constructed diagrams indicated orientationaly two groups of stylolite. The first group lies parallel to the strike strike of the bedding plane with different dip directions, which is nearly horizontal is the diagenetic one.

II. General Setting

The Ilam Formation is part of the Upper Cretaceous carbonate sequence deposited on the northern and southern and southern and part of the study area (Zagros Basin) (Fig.1). Basin subsidence and sediment accumulation began during the Lias.

III. Aim of study

Because of abundance of stylolites in the rocks of the study area, this investigation was conducted to distinuish symmetical relationship between macroscopic dominant sructures and the above

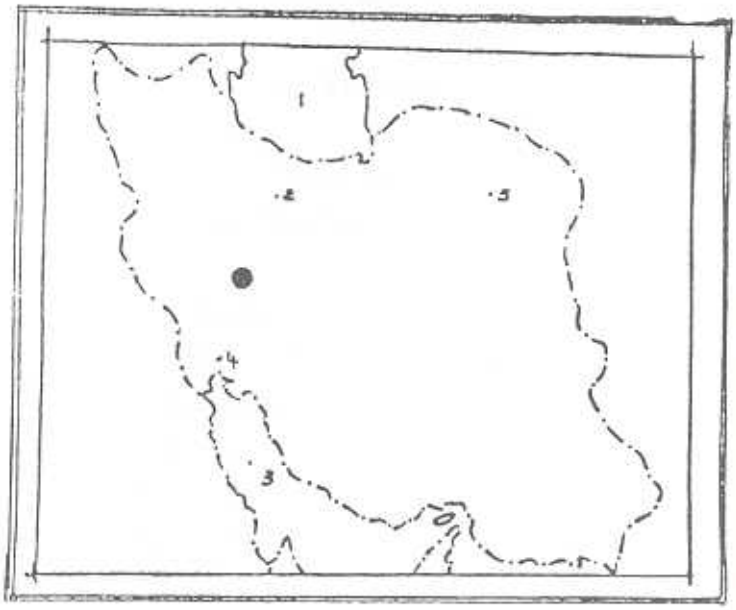
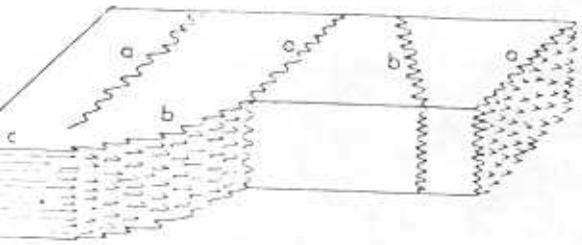


Fig. 1. 1) Caspian Sea, 2) Tehran, 3) Persian Gulf 4) Ahvaz, 5) Mashad, 6) Study area.

mentioned stylolites. In other words, the aim of udy is to differentiate the tectonic stylolites from e diagenetic one.

IV. Gneral Concept

Stylolites are very irregular discontinuities that ow alternating peaks and hollows that respond to each other on the two surfaces (Fig. In cross section their appearance



2. Examples of stylolites. (a) Symmetrical stylolites. symmetrical stylolites, which can lead to a fracture lip striations (c).

milar to the curves produced by some rding instruments (e.g.seismographs). cal and sylindrical stylolites can be guished by their appearance. The lateral nsion of conical stylolites range from a few f millimeters to few centimeters, while of the columns of sylindrical stylolites range a few millimeters or centimeters up to several f centimeters.

lolites are therefore, extremely irregular and m planar. In some places, the irregular joint surfaces can be coated with a thin film of clay or a light coating of clay residues or insoluble iron oxides. Stylolites are often found in carbonate rocks and occasionally in sandstones.

Stylolites form in rocks, under the influence of compressive stress that force together rocks on either sides of a discontinuity. The two sides interpeneterate as a result of dissolution of the rock matrix near the boundary between them.

Shaubs's theories (1939, 1949, 1955), which suggested that stylolites form before rock consolidation, are no longer regarded as valid. Nevertheless, numereous authors (Blake and Roy, 1949; Dunnington, 1945; Park and Schot, 1968 a and b; Rigby, 1953; Stockdale, 1945) considered that stylolites form after lithification but during diagenesis.

More recently, stylolites, whose origin is certainly tectonic, have been described (Arthaued and Mattaure, 1969; Beiersdorf, 1969; Jarozewski, 1969; Wagner 1967). Moreover, Arthaued and Mattaure (1972), studying some stylolites parallel to stratification, showed clearly that they were formed during a stage of tectonic activity.

Sylindrical stylolites could be diagenetic in origin, while tectonic stylolites seem more likely to be conical type (Fig. 3).

In stylolites, the peaks and columns are always parallel to the shortening direction. The joints with symmetrical and asymmetrical stylolites are

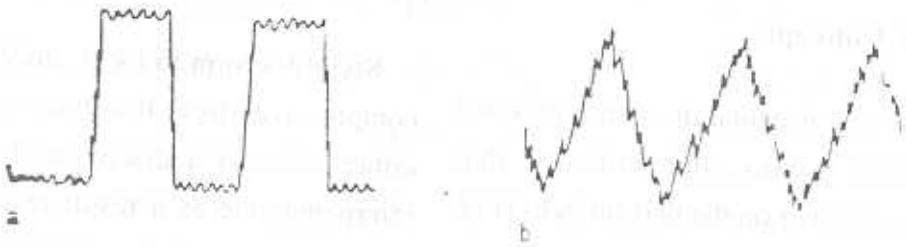


Fig. 3. Cross-section of (a) sylindrical stylolites (b) conical stylolites.

perperdicular and oblique to the shortening direction, respectively. For this reason, on a given surface, symmetrical stylolites involve greater dissolution of the rock than asymmetrical stylolites. Depending on spatial arrangement of pre-existing discontinuities or fissures, every kind of stylolites is possible, from symmetrical to asymmetrical.

V. Observations and analysis

As already mentioned, one of the most important rock unit in the study area is the Ilam Formation. Stratigraphicaly the Formation lies between Sarvak and Gurpi formarions (Upper Cretaceous). Lithologically it consists of well bedded gray argilaceous limestone with a tickness of about 190 m.

Field observations clearly show two kinds of stylolites. Some of them are parallel in orientation to the bedding planes of the Ilam Formation (Fig.4) and the others are oblique (Fig. 5&8).

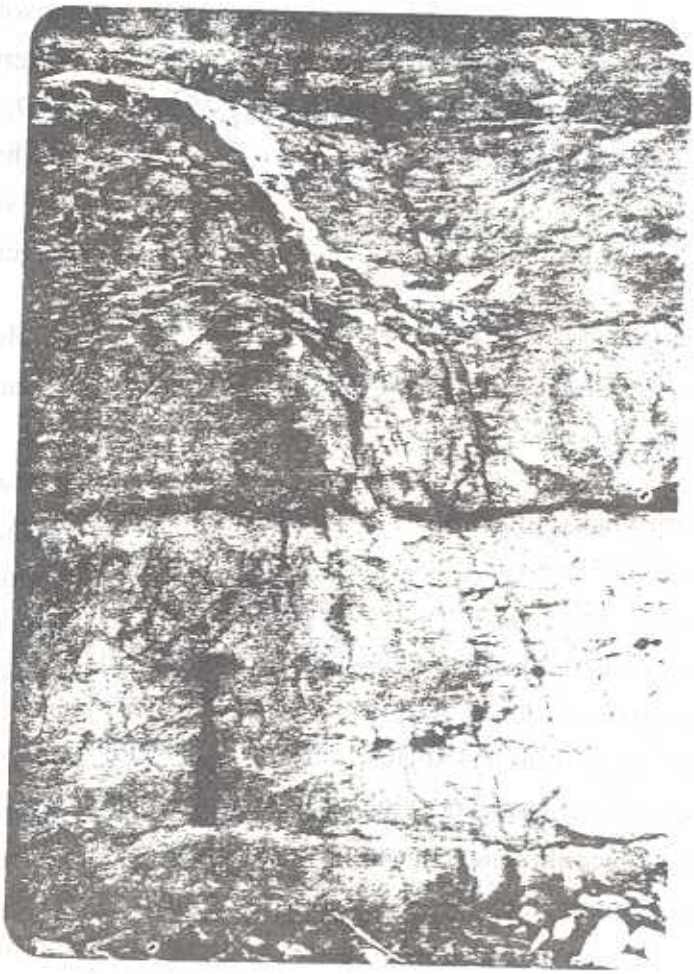


Fig. 4. Stylolites parallel to the bedding planes.

cording to a structural and geometrical is of the rocks in the study area, numerous te surfaces was observed and measured.

reogram of Fig. 7 is a point diagram of all te surfaces in the Ilam Formation and shows two groups of stylolites. The first groups ose that their polepoints lie planes.in NNE

and meso folds of the Ilam Formation, inthe area were constructed and stereograms were drawn (S. Parsi 1989). A correlation between stereogram of Fig. 7 with Fig. 8 shows that the first group of stylolites are parallel to the bedding planes with different dip directions (60°-80°). These are tectonic stylolites in summetry, because they are perpendicular to the A-axis, which represents the

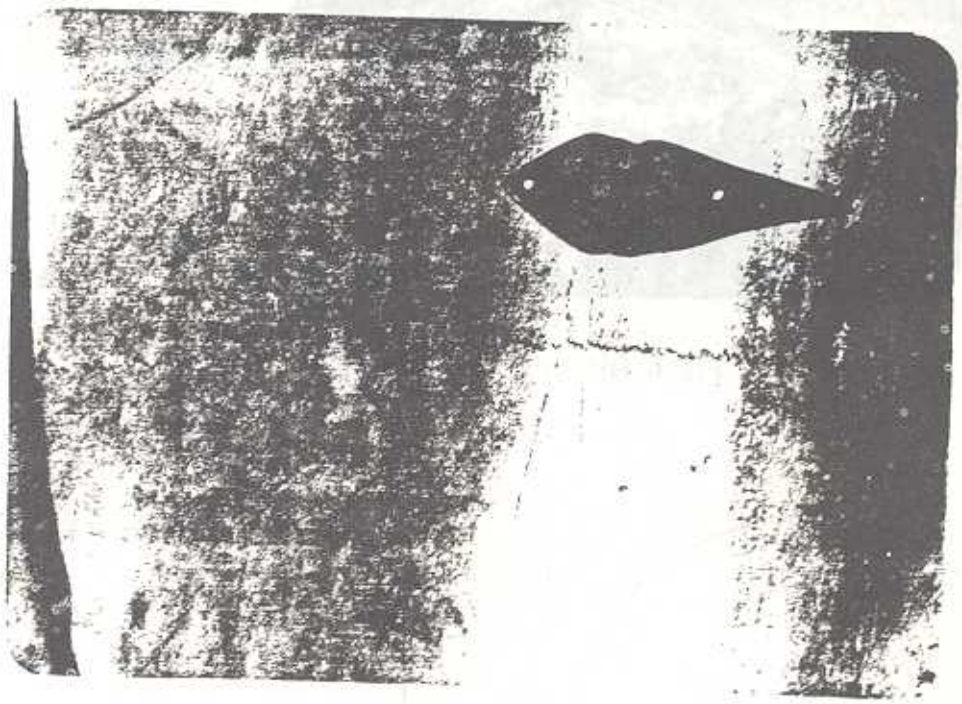


Fig. 5. Styloites oblique to the bedding

V sectors of the stereogram. This position oles means that this group of stylolite trike NW-SE, but with different dip . the polepoint of the second group lie in llo part of stereogram which means dip o them is around zero.

clear relationship between macroscopic oscopic dominant folds and stylolites of Formation, the tectonic axes of macro

greatest principal stress direction. That means that the shortening is occured in the NE-SW direction.

The existence of extension fractures perpendicular to B-axis of the folds in the area confirmed the tectonic character of the mentioned stylolites.

The polepoint of the second group, which lies in the middle part of the stereogram means that

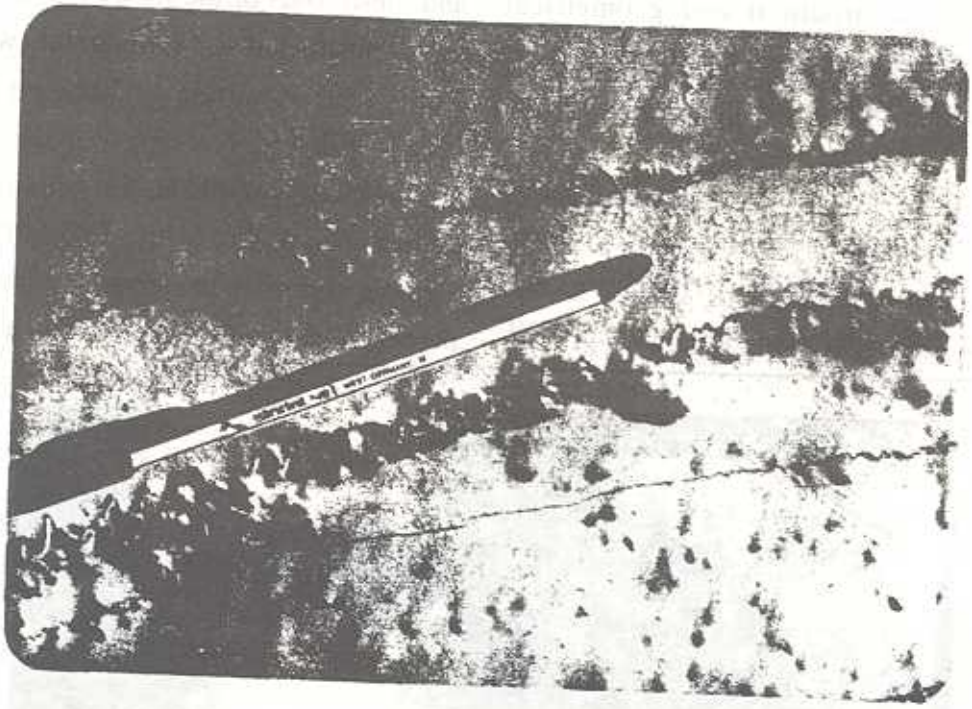


Fig. 6. Stylolite to the bedding planes.

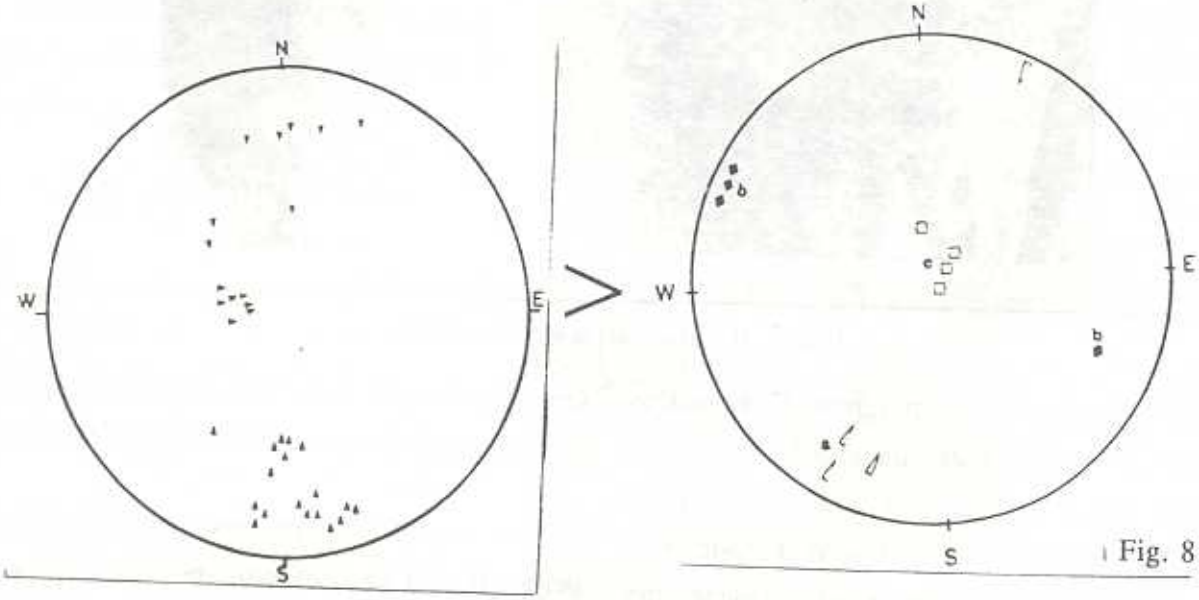


Fig. 7. Point diagram of all stylolite surfaces in the Ilam Formation.

they are nearly horizontal and could be categorized as diagenetic stylolites.

According to the results of the stereogram analysis it appears that both tectonic and diagenetic stylolites are present in the Ilam Formation.

CKNOWLEDGEMENT

hanks to my dear colleagues Dr. Y.LASEMI Dr. S. AMINI for their critical review of ıscript and constructive remarks.

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